**AMENDMENTS TO THE CLAIMS:**

This listing of the claims will replace all prior versions, and listings, of the claims in this application.

**Listing of Claims:**

Claims 1-15 (Cancelled)

16. (Currently Amended) A receiver for receiving data and pilot symbols simultaneously over multiple channels comprising:

at least one antenna;

a demodulator coupled to an output of the antenna for demodulating received symbols in accordance with a multi-carrier transmission technique,

a channel estimator coupled to the demodulator for estimating a channel of a multi-carrier system using received pilot symbols;

a storage medium for storing a multi-level signal constellation defining C points, of which at least one point defines a first level and a plurality of points define a second level, and a minimum inter-level distance between points is based on a maximized minimum difference between conditional probability distributions; and

a mapper coupled to the demodulator and to the storage medium for converting the demodulated symbols to a plurality of data signals that each alone or in combination correspond to a constellation point wherein the demodulator determines a maximum likelihood conditional probability distribution of the received symbols and ~~The receiver of claim 15~~ wherein the conditional probability distribution is

$$p\left(X_i|S_i,\hat{H}_i\right)=\mathrm{E}_{\tilde{H}_i}\left\{p\left(X_i|S_i,\hat{H}_i,\tilde{H}_i\right)\right\}=\frac{1}{\pi\left(\sigma^2+\sigma_E^2\|S_i\|^2\right)}\exp\left\{-\frac{\left\|X_i-S_i\hat{H}_i\right\|^2}{\sigma^2+\sigma_E^2\|S_i\|^2}\right\}$$

such that the detector maximizes over at least two possible values for $S_i$ to find a transmitted symbol wherein .$S_i$ comprises a transmitted signal vector, $\hat{H}_i$ comprises a channel estimate matrix, $X_i$ comprises a received signal vector, and $\tilde{\mathrm{H}}_i$ comprises an estimation error matrix at an $i^{th}$ frequency bin.

Claims 17-21. (Cancelled)

22. (Currently Amended) A method for decoding a signal received over a multi-carrier system comprising:

receiving a set of signals that were transmitted from at least M transmit antennas from a multi-carrier channel, wherein M is an integer at least equal to two;

using a portion of the set of signals to estimate channels of the multi-carrier system;

decoding at least a portion of the set of signals by mapping them to a signal constellation, the signal constellation defining a plurality of C constellation points and $n$=2M real dimensions, wherein the C points are disposed about at least two mutually exclusive subsets such that a separation between two nearest constellation points of adjacent subsets is based on a maximized minimum difference between conditional probability distributions; and ~~The method of claim 19 further comprising~~ selecting a proper signal constellation such that a signal to noise ratio defined by the received set of signals is equal to or greater than a sum of the squares of the absolute value of each constellation point divided by C.

Claims 23-24. (Cancelled)

25. (Currently Amended) A method for decoding a signal received over a multi-carrier system comprising:

receiving a set of signals that were transmitted from at least M transmit antennas from a multi-carrier channel, wherein M is an integer at least equal to two;

using a portion of the set of signals to estimate channels of the multi-carrier system; and

decoding at least a portion of the set of signals by mapping them to a signal constellation, the signal constellation defining a plurality of C constellation points and $n$=2M real dimensions, wherein the C points are disposed about at least two mutually exclusive subsets such that a separation between two nearest constellation points of adjacent subsets is based on a maximized minimum difference between conditional probability distributions

wherein mapping at least a portion of the set of signals to the signal constellation comprises determining a conditional probability distribution of each symbol within the at least a portion of the set of signals and ~~The method of claim 24~~ wherein the conditional probability distribution is

$$p\left(X_i|S_i,\hat{H}_i\right)=\mathrm{E}_{\tilde{H}_i}\left\{p\left(X_i|S_i,\hat{H}_i,\tilde{H}_i\right)\right\}=\frac{1}{\pi\left(\sigma^2+\sigma_E^2\|S_i\|^2\right)}\exp\left\{-\frac{\|X_i-S_i\hat{H}_i\|^2}{\sigma^2+\sigma_E^2\|S_i\|^2}\right\}$$

that is maximized over at least two possible values for $S_i$ for each symbol and wherein.$S_i$ comprises a transmitted signal vector, $\hat{H}_i$ comprises a channel estimate matrix, $X_i$ comprises a received signal vector, and $\tilde{H}_i$ comprises an estimation error matrix at an $i^{th}$ frequency bin.